IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPLICANT:	Avetik Harutyunyan
APPLICATION NO.:	10/658,711
FILING DATE:	September 8, 2003
TITLE:	Methods For Preparation Of One-Dimensional Carbon Nanostructures
EXAMINER:	Kelly M. Stouffer
GROUP ART UNIT:	1792
ATTY. DKT. NO.:	23085-08273

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Dated: June 19, 2008 By: /Narinder Banait/
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APPEAL BRIEF

Sir:

This Amended Appeal Brief is hereby filed within 1 month from the mailing of the Notification of Non-Compliant Appeal Brief.

Real Party in Interest

The subject patent application is owned by Honda Motor Co., LTD.

Related Appeals and Interferences

There are no prior or pending appeals, interferences, or judicial proceedings known to the appellant, the appellant's legal representative, or the assignee, which may be related to, directly affect, be directly affected by, or have a bearing on the Board's decision in this pending appeal.

Status of Claims

Claims 1-19 are pending and stand finally rejected in a Final Office Action mailed August 21, 2007.

Claims 20-42 were canceled in an amendment filed on July 13, 2007.

Appellant appeals from the final rejection of all the finally rejected claims 1-19, which are set forth in an appendix attached hereto.

Status of Amendments

Applicant did not amend the claims after the Final Rejection.

Summary of Claimed Subject Matter

Appellant's invention provides methods for the synthesis of carbon nanostructures on targeted locations on a substrate (Spec. page 5, lines 13-20). The application contains a single independent method claim. The method for synthesizing carbon nanostructures on targeted locations comprises a substrate wherein one of its surfaces has regions covered with a mask and

regions that are uncovered or unmasked. The unmasked regions denote the areas targeted for the synthesis of nanostructures. A metalorganic layer is deposited on the unmasked regions, and the organic component is then removed to give catalytic metal particles at particular locations on the substrate. The substrate having catalyst particles formed on its surface is then exposed to a carbon precursor gas to give the nanostructures (Spec. page 25, line 10, to page 26, line 10). Thus, nanostructures are produced at the locations of the catalyst particles by a chemical vapor deposition (CVD) process.

Grounds of Rejection to be Reviewed on Appeal

Whether claims 1, 3-15, and 17-19 are unpatentable under 35 U.S.C. §103(a) U.S. Patent No. 6,232,706 to Dai *et al.* (Dai) in view of U.S. Patent Application Publication 2002/0036452 to Muroyama *et al.* (Muroyama).

Whether claim 2 is unpatentable under 35 U.S.C. §103(a) over Dai and in view of Muroyama and U.S. Patent No. 5,863,601 to Kikuchi *et al.* (Kikuchi).

Whether claim 16 is unpatentable under 35 U.S.C. §103(a) over Dai and in view of Muroyama and U.S. Patent No. 4,650,895 to Kadokura *et al.* (Kadokura).

Grouping of Claims

For the purposes of the specific arguments made by the appellant in the present appeal, claims 1-19 stand or fall separately.

Argument

Rejection of claims 1, 3-15 and 17-19 under 35 U.S.C. §103(a)

On pages 3-6 of the Final Office Action mailed August 21, 2007, claims 1, 3-15, and 17-19 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 6,232,706 to Dai *et al.* (Dai) in view of U.S. Patent Application Publication 2002/0036452 to Muroyama *et al.* (Muroyama). The Examiner stated that Dai discloses use of metal oxides as catalysts but did not disclose the use of metalorganics as catalyst. Muroyama discloses metalorganic catalysts. The Examiner stated Muroyama's metalorganic catalyst could have been substituted for the metal catalysts of Dai and oxidized, as claimed by the applicant. The rejection was maintained in an Advisory Action mailed October 23, 2007. This rejection is traversed.

This rejection is clearly in error because the Maruyama reference teaches away from combining it with Dai to obtain the catalyst used by the applicant in his invention. An element of the independent claim 1 is oxidizing the metalorganic layer deposited on the unmasked portion of the substrate to form a growth catalyst on the substrate. In contrast, Muroyama clearly states that the oxides of the growth catalyst should be removed prior to using the catalyst. Thus, there is no motivation to combine Dai that teaches catalysts that are oxides of metals with Muroyam that teaches catalysts that are free of oxides.

Muroyama discloses three embodiments of their methods for the synthesis of carbon films and the catalyst for use in all three embodiments is discussed in paragraph 95. Muroyama, in paragraph 95, states that "it is preferred to remove a metal oxide (so-called natural oxide film) on the surface of each metal particle or on the surface of the metal thin layer

or the organometallic compound thin layer." Thus, Muroyama teaches removing the metal oxide in all embodiments of their invention.

Further, Muroyama discloses the use of nickel acetylacetonate as the metalorganic layer in Examples 11 and 12. In both Muroyama examples where the nickel acetylacetonate layer is used as the catalyst, the corresponding metal oxide is removed. Thus, at paragraphs 268 and 276, Muroyama states "after the organometallic compound thin layer is formed, the metal oxide (natural oxide film) on the surface of the organometallic compound thin layer may be also removed in the same manner as in [Step-720] in Example 7." Thus, the Muroyama embodiment that is closest to the applicants' claimed invention, the examples show that the metal oxide is removed.

In the Advisory Action, the Examiner states that removal of the oxides is preferred but not required, and the combined teachings of the references would suggest replacing the metal oxide of Dai with the organometallic catalysts of Muroyama to improve selective growth. The Examiner's reasoning is however refuted by the disclosure of Muroyama. Muroyama, at paragraph 95, states that the reason for removing the metal oxide is to provide for more reliable growth of the carbon film.

> ...for making more reliable the selective growth of the carbon film on the carbon film selective-growth region, after the metal particles are allowed to adhere onto, or the metal thin layer or the organometallic compound thin layer is formed on, the surface of the cathode electrode, it is preferred to remove a metal oxide (so-called natural oxide film) on the surface of each metal particle or on the surface of the metal thin layer or the organometallic compound thin layer.

U.S. Patent Application Publication 2002/0036452 to Muroyama *et al.*, at paragraph 95.

Muroyama then discloses the methods for removing the metal oxide, such as by the use of plasma reduction treatment or by washing with an acid or a base. Upon reading the disclosure of Muroyama, one of skill in the art would conclude that removing the metal oxide from the catalyst surface would provide for the selective growth of carbon film more reliably. Thus, Muroyama would motivate one of skill in the art to remove the metal oxide. Consequently, one would not substitute the metal oxide catalysts of Dai with the organometallic catalyst of Muroyama where the organometallic is subsequently oxidized

The *Takeda Chemical Industries Ltd. V. Alphapharm Pty.,* 83 USPQ 2d 1169 (Fed. Cir. 2007) and *Inpro II Licensing, S.A.R.L. v. T-Mobil USA, Inc.,* 78 USPQ2d 1786 (Fed. Cir. 2006) Federal Circuit decisions support the conclusion that the Examiner has not made a *prima facie* case of obviousness in the present invention.

Takeda Chemical developed the drug ACTOS® that is marketed to control blood sugar in patients suffering from Type 2 diabetes. The active compound in ACTOS® is a TZD compound covered by U.S. Patent No. 4,687,777. It was asserted that the patent was invalid because the TZD compound would have been obvious in light of prior art "compound b" which is structurally similar to the patented TZD compound. The TZD of ACTOS® is pioglitazone that has an ethyl substitutent attached to the 5-position on the pyridyl ring, while "compound b" has a methyl stustitutent attached to the 6-position on the pyridyl ring. The Federal Circuit found that the prior art article reviewed 101 TZD compounds, including "compound b" but recommended using other compounds instead of "compound b" due to its negative side effects. Thus, the art was found to teach away from the patented compound because the negative properties would have directed one of ordinary skill away from selecting the compound for

further investigation, and U.S. Patent No. 4,687,777 was found to be not obvious. Similarly, Muroyama teaches that the presence of oxides leads to unreliable growth. Thus, one of skill would not have selected the organometallic of Muroyama as a catalyst and then oxidized the catalyst as taught by Dai due to undesirable results.

In *Inpro II Licensing, S.A.R.L. v. T-Mobil USA, Inc.*, Inpro accused T-Mobile and Research in Motion of infringement of its patent relating to electronic devices having user-operable input means. Inpro appealed the construction of the term "host interface" where Inpro interpreted "host interface" to include both a parallel bus and a serial bus. The Federal Circuit noted that Inpro's specification only discussed the interface as a parallel bus and that the patent referred to prior-art serial connections as "a big drawback." The Federal Circuit construed the term to require parallel ports and held that T-Mobil did not infringe because it uses serial ports.

Similarly, Muroyama only discloses the single non-oxidized form of their catalyst, Examples 11 and 12 describe only the use of non-oxidized nickel acetylacetonate layer only where the corresponding metal oxide is removed, and the specification states that removing the metal oxide from the catalyst surface provides for reliable selective growth of carbon film. Thus, the disclosure of only the non-oxidized organometallic as the catalyst by Muroyam and the discussion of the disadvantages of the catalyst oxides would lead one of skill not have select Muroyama's organometallic as a catalyst and then oxidize the catalyst as taught by Dai. There is no motivation to combine the teachings of Dai with Muroyama.

The rejection of claims 1, 3-15, and 17-19 cannot stand.

Rejection of Claim 2

Claim 2 was rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Dai and in view of Muroyama and U.S. Patent No. 5,863,601 to Kikuchi *et al.* (Kikuchi).

Claim 2 depends from claim 1 and thus contains all the elements of claim 1. The combination of Dai, Muroyama and Kikuchi does not disclose depositing a metalorganic layer on the substrate and oxidizing the portion of the metalorganic layer deposited on an unmasked portion of the substrate to form a growth catalyst on the substrate. Muroyama in fact discloses removing the oxide that may form when a metalorganic is used as a catalyst, and Kikuchi does not cure the deficiency of Muroyama.

The rejection of claim 2 cannot stand.

Rejection of Claim 16

Claim 16 was rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Dai and in view of Muroyama and U.S. Patent No. 4,650,895 to Kadokura *et al.* (Kadokura).

Claim 16 depends from claim 1 and thus contains all the elements of claim 1. The combination of Dai, Muroyama and Kadokura does not disclose depositing a metalorganic layer on the substrate and oxidizing the portion of the metalorganic layer deposited on an unmasked portion of the substrate to form a growth catalyst on the substrate. Muroyama instead teaches removing the oxide that may form when using metalorganic as a catalyst, and Kadokura does not cure the deficiency of Muroyama.

The rejection of claim 16 cannot stand.

Summary

For the foregoing reasons, Appellant respectfully submit that the rejection of claims 1-19 is clearly erroneous. Reversal of the final rejection of claims 1-19 is respectfully requested.

Respectfully submitted,

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Claims Appendix

The status of the claims is as follows:

1. A method for synthesizing carbon nanostructures comprising:

providing a substrate having a deposition mask;

depositing a metalorganic layer on the substrate, wherein at least a portion of the metalorganic layer is deposited on an unmasked portion of the substrate;

removing the deposition mask from the substrate;

oxidizing said portion of the metalorganic layer deposited on an unmasked portion of the substrate to form a growth catalyst on the substrate; and

exposing the substrate to a carbon precursor gas at a deposition temperature to form carbon nanostructures.

2. The method of claim 1, wherein the metalorganic layer is composed of iron phthalocyanine.

3. The method of claim 1, wherein the metalorganic layer is deposited by a physical vapor deposition process.

4. The method of claim 1, wherein the deposited metalorganic layer has a thickness of between about 1 micron and about 30 microns.

5. The method of claim 1, wherein the deposition mask is composed of a metal oxide.

6. The method of claim 1, wherein the deposition mask is composed of a substance selected from the group consisting of silicon oxide and aluminum oxide.

7. The method of claim 1, wherein the unmasked portion of the substrate has a top surface composed of a metal oxide.

8. The method of claim 7, wherein the metal oxide is selected from the group consisting of silicon oxide, aluminum oxide, and magnesium oxide.

9. The method of claim 1, wherein oxidizing said portion of the metalorganic layer deposited on an unmasked portion of the substrate comprises exposing said portion of the metalorganic layer to an oxygenated atmosphere at a temperature of between about 450°C and about 500°C.

10. The method of claim 1, wherein said portion of the metalorganic layer is exposed to the oxygenated atmosphere for between about 2 hours to about 4 hours.

11. The method of claim 1, wherein the growth catalyst comprises metal growth catalyst particles.

12. The method of claim 1, wherein the carbon precursor gas is methane.

13. The method of claim 1, wherein exposing the substrate to a carbon precursor gas comprises exposing the substrate to an atmosphere containing methane, argon, and hydrogen.

14. The method of claim 13, wherein the substrate is exposed to the carbon precursor gas for between about 15 minutes and about 60 minutes.

15. The method of claim 1, wherein the deposition temperature is about 700°C.

16. The method of claim 1, wherein the metalorganic substance is purified prior to deposition of the metalorganic layer.

17. The method of claim 1, wherein the oxidizing said portion of the metalorganic layer is performed prior to removing the deposition mask from the substrate.

18. The method of claim 1, wherein said carbon nanostructures are single wall carbon nanotubes.

19. The method of claim 1, wherein said carbon nanostructures are one dimensional carbon nanostructures.

20-42 (Cancelled).

Evidence Appendix

None.

Related Proceedings Appendix

None.